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NUTRIENT MANAGEMENT — CAN IT PLAY A ROLE IN CONSERVING FOSSIL FUELS?

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INTRODUCTION

Nutrient management is a tool Ontario farmers use to assist in determining the application rates of manure and other nutrient sources. Manure is a by-product of any livestock operation and is a valuable fertilizer source for crop production (see Figure 1, right). By applying manure to cropland, growers can recycle excreted nutrients contained in the manure. This can lower the need to purchase additional manufactured commercial fertilizers, which consume fossil fuels during their production. This Factsheet outlines the economics of nutrient management and describes a case study that considers optimized nitrogen use.

MANURE USE REDUCES COMMERCIAL FERTILIZER USE

A nutrient management plan (NMP) assesses all the sources of nutrients that are available on the farm. On-farm sources of nutrients include soil reserves, manure supplies (the plan considers the effects that various methods and timing of manure application have on manure nutrient availability) and contributions from previous plowdown and legume crops. Once all the on-farm sources of nutrients have been considered, the amount of commercial fertilizer needed may be less than was previously thought to be necessary to produce an economic yield. This can possibly reduce crop input costs as well as fossil fuel consumption.

Figure 1. Manure application reduces the need for commercial fertilizer applications.

NITROGEN PRODUCTION USING NATURAL GAS

Consider nitrogen. Of the three macronutrients (nitrogen, phosphorus and potassium) commonly found in manufactured fertilizers, nitrogen fertilizers require the greatest amount of energy to produce. Natural gas is a major input in the manufacture of nitrogen (N), both as a source of energy and as a supply of hydrogen (H) to form the ammonia (NH_3) molecule. To industrially fix nitrogen from the atmosphere and produce anhydrous ammonia requires the consumption of approximately 1,050 m^3 (37,100 cu. ft.) of natural gas for every tonne (t) of anhydrous ammonia produced. This readily explains the strong relationship that exists between the price of natural gas and the cost of manufactured nitrogen

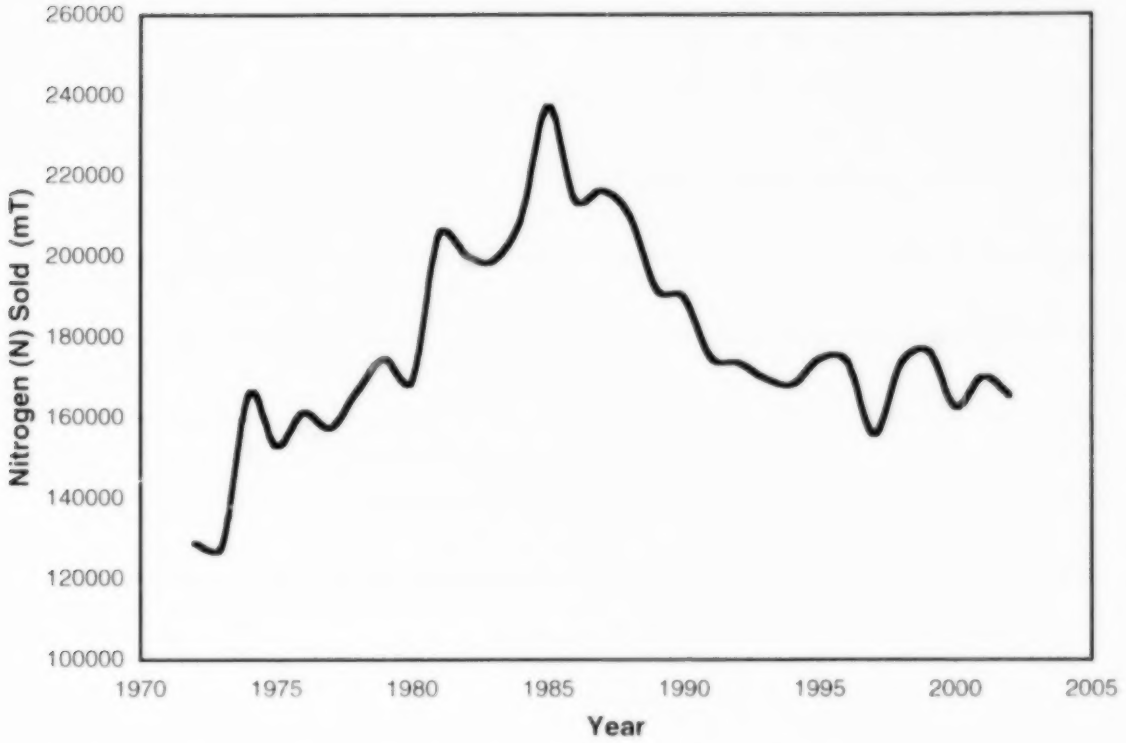

Figure 2. Nitrogen Fertilizer Sold in Ontario (1972–2002)

fertilizers. Ammonia produced using natural gas is used as an input for the manufacture of many of the other common nitrogen fertilizers, including ammonium sulphate, urea, diammonium phosphate (DAP) and monoammonium phosphate (MAP).

The trend in commercial nitrogen fertilizer use in Ontario between 1972 and 2002 is shown in Figure 2, above. From 1998 to 2002, the amount of nitrogen fertilizer sold in Ontario has averaged approximately 170,000 t/yr (187,000 tons/yr). To manufacture this amount of nitrogen fertilizer would require 216 million m^3 (7.7 billion cu. ft.) of natural gas annually. To compare, Ontario residential consumption of natural gas from 1998 to 2002 was in the range of 8.5 billion m^3 (300 billion cu. ft.). Therefore, consumption of natural gas for the purposes of producing commercial nitrogen fertilizers sold in Ontario represents almost 3% of the amount of natural gas that we use in this province to heat and operate our homes. If implementation of NMP recommendations saw a net 10% drop in commercial fertilizer use as a result of fully and more efficiently accounting for all of the nutrients available in manure and previous crops, this would mean roughly a 0.3% drop in natural gas consumption by Ontario.

PARTNERS IN NITROGEN USE EFFICIENCY STUDY

Perhaps a more noticeable impact of reducing commercial fertilizer use can be seen at the farm level. Findings from a long-term study help to illustrate this point. The study was managed by the Ontario Federation of Agriculture (OFA) and involved the local municipality, local university researchers, OMAFRA, and a set of five commercial farms located within a groundwater-sensitive region of the province. The "Partners in Nitrogen Use Efficiency" (PINUE) program involved completing an NMP for each of the five participating farms in the study. It was concluded that, across all farms, an average of 29 kg/ha (26 lb/acre) less fertilizer nitrogen could be used without risking production (yield) loss.

This 29 kg/ha (26 lb/acre) reduction was not consistent across all farms or fields. Some fields (e.g., soybean fields receiving no manure or fertilizer) showed no difference between the NMP-recommended rate and the fertilization rate that was being followed by the producer prior to completing the NMP. However, corn fields that received manure or that followed a legume crop often had the potential to significantly reduce commercial fertilizer application rates. Net savings in input costs for the producer as a result of

following the NMP-recommended N fertilization rates ranged from $3.70/ha to $49.50/ha ($1.50/acre to $20.00/acre). For this particular 313-ha (773-acre) study site, reducing the amount of commercial fertilizer used by an average of 29 kg/ha (26 lb/acre) resulted in the manufacture of approximately 11 t (12 tons) less of anhydrous ammonia. This converts to a savings of about 11,400 m^3 (402,000 cu. ft.) of natural gas/year. This is approximately the amount of gas it would take to heat for 1 year the home of each of the five producers involved in the study. This is yet another demonstration of the larger impacts of good nutrient management practices.

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